An Outbreak of Hepatitis E in a Rural Area of Islamabad, Pakistan in April-May 2019: A Teaching Case-Study

Student's Guide

Nosheen Ashraf, MBBS
National Institute of Health, Islamabad, Pakistan
Email: nosheenawan@hotmail.com

Wasif Malik, DVM, MS (Field Epidemiology)
National Institute of Health, Islamabad, Pakistan
Email: drwasifus@hotmail.com

Mumtaz Ali Khan, MD, MS (Field Epidemiology)
National Institute of Health, Islamabad, Pakistan
Email: drmomi74@hotmail.com

Jamil A. Ansari, MBBS
National Institute of Health, Islamabad, Pakistan
Email: jam62aa@gmail.com

Aamer Ikram, PhD
National Institute of Health, Islamabad, Pakistan
Email: maahin1@yahoo.com

Corresponding author
Nosheen Ashraf
Field Epidemiology and Disease Surveillance Division (FEDSD)
National Institute of Health (NIH), Islamabad
Pakistan
Email nosheenawan@hotmail.com

Abstract

Hepatitis E is an acute viral infection caused by the Hepatitis E virus (HEV). An estimated 20 million HEV infections occurred worldwide and 3.3 million became symptomatic. The transmission route of the virus is fecal-oral via water contamination. This disease is prevalent in low- and middle-income countries with no proper sanitation system, water supply, and hygiene and health services. Sporadic cases of Hepatitis E occur throughout the year in Pakistan. Pakistan is a highly endemic area for Hepatitis E and small epidemics occur in different cities of the country. HEV is transmitted when sewage water mixes and contaminates the water supply pipelines due to broken pipelines or open drainage systems. Anti-HEV IgM and IgG antibodies are the serological markers to confirm the cases, also HEV's RNA is a useful epidemiological marker. The incubation period of the virus ranges from 2 to 10 weeks, with an average of 40 days.

The goal of this case study is to develop student's capabilities in investigating outbreaks. This case study will help students learn about the methods of outbreak investigation and the features of an outbreak which could help them analyze surveillance data in order to find the causes of an outbreak. The case study will also help students determine the environmental factors leading to disease outbreaks, the significance of creating public awareness about an outbreak and the necessary preventive measures, multi-sectorial involvement towards preventing disease outbreaks in the community, and creating contingency action plans for outbreaks.

Keywords: Hepatitis E, water contamination, Pakistan

How to Use the Case Study

General instructions: This case study should be used as adjunct training material for novice epidemiology trainees to reinforce the concepts taught in prior lectures. The case study is ideally taught by a facilitator in groups of about 20 participants. Participants are to take turns reading the case study, usually a paragraph per student. The facilitator guides the discussion on possible responses to questions. The facilitator may make use of flip charts to illustrate certain points. Additional instructor's notes for facilitation are coupled with each question in the instructor's guide to aid facilitation.

Audience: This case study was developed for novice field epidemiology students. These participants are commonly health care workers working in the county departments of health whose background may be as medical doctors, nurses, environmental health officers or laboratory scientists who work in public health-related fields. Most have a health science or biology background.

Prerequisites: Before using this case study, participants should have received lectures on disease surveillance and outbreak investigation.

Materials needed: Flash drive, flip charts, markers, computers with MS Excel

Level of training and associated public health activity: Novice – Outbreak Investigation

Time required: 2-3 hours

Language: English

Goal of Case Study:

The goal of this case study is to develop student's capabilities in investigating outbreaks.

Learning Objectives

At the conclusion of the teaching session, participants will be able to:

1. Define an outbreak
2. List the steps of outbreak investigation
3. Identify the role of the laboratory in disease surveillance systems
4. Identify the determinants of an outbreak and create an action plan to control an outbreak
5. Recognize the importance of communicating findings during outbreaks
6. Conduct descriptive analysis of data using MS excel

Introduction

Hepatitis E virus (HEV) is a positive stranded RNA virus which causes acute hepatitis [1]. Infection with HEV is endemic in developing countries and sometimes leads to epidemics due to the existence of favorable conditions for the virus in those countries [2]. HEV typically spreads by fecal contamination of water [3].

HEV is one of the major causes of acute viral hepatitis in Pakistan where it mostly affects adults from lower socioeconomic groups; Pakistan is endemic for HEV [4]. The country experiences all four seasons, and due to lack of proper sanitation and infrastructure, the rainy season leads to floods in the country [5].

Islamabad is the capital city of Pakistan. It is divided into two administrative subdivisions that is Islamabad urban and Islamabad rural. The city is divided into 52 union councils, of which 24 are urban union councils and 28 are rural union councils. Union council Tarlai Kalan is in the rural area of Islamabad [6, 7].This particular outbreak was investigated in the Irfanabad town in the Tarlai Kalan union council. The total population of Pakistan is approximately 200 million, and the total population of the Tarlai union council is approximately 244,000. The outbreak investigation area included 100 residences housing around 500 people. The streets of the investigation area had an open drainage system, and garbage was disposed of on the streets, which were not fully cemented. Most of the water bore pumps are located street side outside homes. There are no proper water supply connections in this town. Map in figure 1 is showing the location of Islamabad city in Pakistan [8].

Figure 1. Map of Pakistan [8]

Part 1: Story

On the 24th of April 2019, a call was received at the National Institute of Health (NIH) in Islamabad from a resident of the Irfanabad town. The caller was worried since his family and neighbors had fallen sick and displayed fever, lethargy, abdominal pain, and vomiting for the last few days. As an FETP fellow, I was requested to go with an outbreak investigation team to that area. A questionnaire was designed to investigate the situation (Annex 1). During investigation, it was observed that the town was unhygienic, the streets were full of garbage dumps, and there was stagnant water with algae growth. The team reached the home of the person who informed the NIH about the illness and found his two sons and daughter to be ill.

Part 1 Questions

Question 1. What is the probable cause of the illness in the cases?
Question 2. What type of questionnaire should be made? Group the questionnaires questions into categories.
Question 3. What is the purpose of creating an investigation team?
Question 4. What type of case definition should be made?
Question 5. What preparedness is required before visiting the field to investigate the outbreak? Who should be on the investigation team?

Part 2 Methods

The next day, the team visited the field with a designed questionnaire, where door-to-door surveillance and face to face interviews took place. During surveillance, it was found that there was no proper water supply in the town and the only mode of supply was three water boring pumps on the street. Two neighbors who shared water from one pump and their neighbors who got water from the other two pumps were all affected by illness. The team visited every house in the community to carry out door-to-door surveillance, and seven illness cases were found on the first

day of field investigation. Blood samples were sent to the NIH laboratory for testing. Four days later, three more affected people were investigated.

Questionnaires were filled out and blood samples were sent to NIH laboratory for confirmation of the disease. Water samples from the pumps and the filtration plants were also sent to the laboratory for testing as an environmental sample. Random water sampling was also carried out by taking samples from pumps in an area three streets away from the affected street, which was also used by the community for drinking and household purposes. The team conducted community interviews and questionnaires were filled-out in order to avoid missing other illness cases, and follow-up procedure was started.

Part 2 Questions

Question 6. What samples should be taken for testing? What etiological agent should the lab test for?

Question 7. What are the recommendations for sample collection, transportation, and testing?

Question 8. What is the role of the laboratory in this scenario?

Question 9. What is the importance of line listing?

Part 3: Results

Line listing was completed based on the questionnaires filled-out in the community and attack rates were calculated in the specified population. Information was collected regarding 55 suspected cases out of which 11 were laboratory confirmed HEV cases for the period spanning April to May, 2019.

The questionnaire was developed based on data regarding demographic information, clinical features, and risk factors of the patients, a pumped water samples were collected for lab testing. Data entry and cleaning was carried out using Microsoft excel and descriptive analysis using Epi Info (Annex 2). The data was grouped, tabulated, and represented graphically, while geographic locations of cases were mapped. Figure 2 is showing the affected age groups. A survey of the entire community was carried out to find any new cases.

Eleven cases (20%) were confirmed to have HEV and showed illness signs and symptoms (table 1), they were all were living on the same street. During investigation it was found that it had rained about a week ago and rainwater had accumulated on the streets due to the lack of a rain-water drainage system.

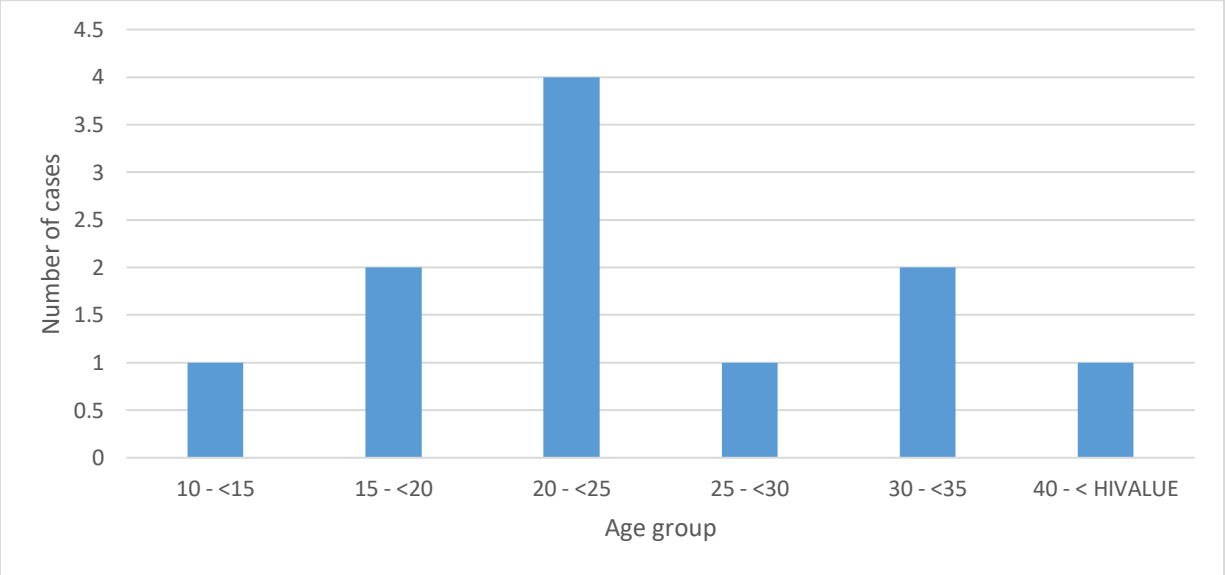

Figure 2. Frequency of HEV Infections by Age Group

Table 1. Patient Data Collected from the Questionnaire and Lab Results

Symptoms	Percent
Fever	100.00%
Lethargy	100.00%
Anorexia	63.64%
Jaundice	63.64%
Vomiting	54.55%
Urine discoloration	81.82%
Gender	
F	54.55%
M	45.45%
Health Status	
ill	100.00%
Lab confirmation	
Hepatitis E IgM	100.00%
Hospitalization	18.18%
Outdoor Eating	81.82%
Source of Drinking Water	
Boring	72.73%
Filtration	27.27%
Source of Water for House Consumption	
Boring	100.00%

Part 3 Questions

Question 10. What is the importance of the spot map (Annex 3)?

Question 11. How will you interpret the provided data analysis?

Question 12. How will you calculate the attack rate of the population?

Question 13. What is the most probable mode of transmission?

Question 14. Which is the most affected age group?

Part 4: Discussion

The most probable cause of the illness was the source of drinking water used by the cases. Persons who were using filtered water from the filtration plants and water tankers did not develop any symptom and remained well; water samples from filtration plants and water tankers were also sent to laboratory for testing. People who used water from bores in their homes also remained well. The eleven illness cases resided in the same street and used drinking water from water bores on the street. The street had an open drainage system located adjacent to the water bores. After the reported rains, the drains over flooded and the street was filled by rain and drainage water. Due to the low surface level of the three water bores that were uncovered, accumulated street water entered the bores. Figure 3 is showing the open drainage system adjacent to boring of the water

Figure 3. Photos of the Affected Area showing the Water, Drainage, and Sewage Systems

Hence boring water was contaminated with street water.

Part 4 Questions

Question 15. Which department should be involved to stop the outbreak?

Question 16. What is the role of information, education and communication (IEC) material?

Question 17. What precautions would prevent the further spread of the disease?

Question 18. What is the difference between active and passive surveillance?

Part 5: Conclusion

Due to open sewage drains located adjacent to water boring pumps which were at a lower surface level, rainwater accumulated up to a level above three of the borings in the same area which lead to contamination of the pump water. The people who were not using the street water bore remained well.

The investigation team followed-up with the confirmed and suspect cases regularly, and awareness sessions were carried out by the team to community members regarding safe water usage through the boiling of drinking water, and advised people not to use the boring water due to the presence of coliforms (according to laboratory reports).

The community stopped using the bore water and repaired the water bores to prevent any accumulated street water from entering the bore. The municipal corporation and the water and sanitation department were informed of the problem and they repaired the open sewage lines of the street.

The District Health Office sent sanitary inspectors along with the investigation team to perform door-to-door awareness regarding preventive disease control measures. The NIH conducted a training session for the 14 health workers of the local union council to raise their awareness about acute viral hepatitis, and explain preventive measures to them. The health workers of the union council were also involved in later health awareness activities, followed-up on existing cases, and reported any new suspected case, if they found any. Follow-up of the cases took place twice a week for two months to find any new suspected cases. No new case were found due to newly instilled awareness of community members regarding safe water use for drinking and household purposes.

Question 19. Based on the preliminary findings above, what control and prevention measures do you think should the investigating team recommend?

Question 20. What actions would you take to engage the community while implementing prevention and control measures?

Acknowledgements

We wish to acknowledge the Eastern Mediterranean Public Health Network (EMPHNET) for their support to develop this case study. We would also like to acknowledge the team at the National Institute of Health, Islamabad, who conducted the outbreak investigation on which this case study is based.

Annex 1: The questionnaire

Annex 2: Excel sheet (Hepatitis E outbreak all suspected and confirmed cases)

Annex 3. Hepatitis E cases spot Map

References:

1. World Health Organization8July2019availablefrom:https://www.who.int/news-room/fact-sheets/detail/hepatitis-e
2. WHO-Eastern Mediterranean regional organization Iftikhar Ahmed Malik and Waheed uz Zaman Tariq Available from: http://www.emro.who.int/emhj-volume-2-1996/volume-2-issue-1/article17.html
3. Nimgaonkar I, Ding Q, Schwartz RE, Ploss A. Hepatitis E virus: advances and challenges. Nat Rev Gastroenterol Hepatol. 2018; 15(2):96-110. doi:10.1038/nrgastro.2017.150
4. Himmelsbach K, Bender D, Hildt E. Life cycle and morphogenesis of the hepatitis E virus. Emerg Microbes Infect. 2018; 7(1):196. Published 2018 Nov 29. doi:10.1038/s41426-018-0198-7
5. Kamar Nassim, Bendall Richard, Legrand-Abravanel Florence, Xia Ning-Shao, Ijaz Samreen, Izopet Jacques, Dalton Harry R. (2012) Hepatitis E. The Lancet, 379 (9835), 2477 https://doi.org/10.1016/S0140-6736(11)61849-7
6. Shahzad F, Atiq M, Ejaz S, Hameed S. Hepatitis E: review of a disease endemic in Pakistan. J Pak Med Assoc. 2001 Apr; 51(4):166-9
7. Capital Development Authority *www.cda.gov.pk*. Retrieved 21 May 2019.
8. Google earth pro used for maps. Available From: https://earth.google.com/web/